

CLAIM SET AS AMENDED

1. (currently amended) A method for estimating one of the frequency (f_{a1}) and the phase (ϕ_{a1}) of a digital input signal ($x(i)$) having the following process steps:

- determining phase values ($C_{a1}(i)$) of the digital input signal ($x(i)$),
- summing the phase values ($C_{a1}(i)$) over a predetermined summation length N/B which is a predetermined fraction $1/B$ of an observation length of N phase values ($C_{a1}(i)$), to create added-up phase values ($S_{a1}(i)$),
- reducing a sampling rate of the added-up phase values ($S_{a1}(i)$) by the factor N/B in comparison with a sampling rate (f_{a2}) of the phase values ($C_{a1}(i)$),
- delaying the added-up phase values ($S_{a1}(i)$) with at least $B-1$ delay elements, each of which delays the added-up phase values ($S_{a1}(i)$) by one sampling period of the reduced sampling rate ($f_{a2} \cdot B/N$),
- adding up the delayed ~~differentlly-delayed~~ added-up phase values ($S_{a1}(i)$) to create a resulting pulse response (h_f) of the frequency so that one of the resulting pulse responses (h_f) of the frequency (f_{a1}) is constant positive in a first interval $[(40)]$, is zero in a second interval $[(41)]$, and is constant negative in a third interval (42), and such that a ~~[[the]]~~ resulting pulse response

(h_ϕ) of the phase ~~that~~ is constant in at least a middle interval $[(43)]$ of the observation length $[(N)]$ and is otherwise zero.

2. (currently amended) The method of claim 1, wherein the fraction $1/B$ is $1/(3 \cdot n)$, where n is a positive $[(an)]$ integer.

3. (currently amended) The method of claim 2, wherein the fraction $1/B$ is $1/3$, wherein a first delay element and second delay element ~~two delay elements (15, 16)~~ are provided, and wherein the added-up phase value ($S_{a1}(i-2)$) at the output of the second delay element ~~(16)~~ is subtracted from the added-up phase value ($S_{a1}(i)$) at the input of the first delay element ~~(15)~~ to determine the estimated frequency (f_{a1}).

4. (currently amended) The method of claim 2, wherein the fraction $1/B$ is $1/3$, wherein a first delay element and second delay element ~~two delay elements (15, 16)~~ are provided, and wherein the added-up phase value ($S_{a1}(i)$) at the input of the first delay element $[(15)]$, the added-up phase value ($S_{a1}(i)$) at the output of the first delay element, $[(15)]$ and the added-up phase value ($S_{a1}(i-2)$) at the output of the second delay element $[(16)]$ are summed to determine the estimated phase (ϕ_{a1}).

5. (currently amended) The method of claim 2 $[[3]]$, wherein the

fraction $1/B$ is $1/6$, wherein a first, second, third, fourth, and fifth ~~five~~ delay elements ~~(26-30)~~ are provided, and wherein the added-up phase value at the input of the first delay element $[(26)]$ and the added-up phase value $(S_{a1}(i-1))$ at the output of the first delay element $[(26)]$ are added, and from this the added-up phase values $(S_{a1}(i-4))$ at the output of the fourth delay element $[(29)]$ and $(S_{a1}(i-5))$ at the output of the fifth delay element $[(30)]$ are subtracted to determine the estimated frequency (f_{a1}) .

6. (currently amended) The method of claim 2 $[[4]]$, wherein the fraction $1/B$ is equal to $1/6$, wherein a first, second, third, fourth, and fifth ~~five~~ delay elements ~~(26-30)~~ are provided, and the added-up phase values $(S_{a1}(i-1))$ at the output of the first delay element $[(26)]$, $(S_{a1}(i-2))$ at the output of the second delay element $[(27)]$, $(S_{a1}(i-3))$ at the output of the third delay element $[(28)]$ and $(S_{a1}(i-4))$ at the output of the fourth delay element $[(29)]$ are summed to determine the estimated phase (ϕ_{a1}) .

7. (currently amended) The method of claim 1, wherein each of the first interval ~~intervals~~ $[(40)]$, the second interval, $[(41)]$ and the third interval $[(42)]$ of the resulting pulse response (h_f) of the frequency has a length of N/B , in particular $1/3 N$.

8. (currently amended) The method of claim 1, wherein the middle interval $[(43)]$ of the resulting pulse response (h_ϕ) of the phase has the length $N \cdot (3n-n)/3 \cdot n$, in particular $2/3 N$, where n is a positive integer.

9. (currently amended) The method of claim 1, wherein the middle interval $[(43)]$ of the resulting pulse response (h_ϕ) extends over the total observation length N .

10. (currently amended) An apparatus for estimating the frequency (f_{a1}) and/or the phase (ϕ_{a1}) of a digital input signal $(x(i))$, the apparatus comprising:

- a phase determining device, $[(3)]$ which determines phase values $(C_{a1}(i))$ of the digital input signal $(x(i))$,
- a first filter $[(4)]$, which adds up the phase values $(C_{a1}(i))$ over a predetermined summation length N/B , which is a predetermined fraction $1/B$ of an observation length of N phase values $(C_{a1}(i))$, to form added-up phase values $(S_{a1}(i))$, and the sampling rate of the added-up phase values $(S_{a1}(i))$ is reduced by a factor N/B in comparison with a sampling rate (f_{a2}) of the phase values $(C_{a1}(i))$,
- a second filter $[(8)]$ which delays the added-up phase values $(S_{a1}(i))$ in a chain of at least $B-1$ delay elements ~~$\{15, 16, 26-30\}$~~ , which respectively delay the added-up phase values $(S_{a1}(i))$ by one sampling period of the reduced sampling rate $(f_{a2} \cdot B/N)$, and adds or

subtracts the ~~differently-delayed~~ delayed added-up phase values $(S_{a1}(i))$ to create a resulting pulse response (h_f) of the frequency so that at least one of: a resulting pulse response (h_f) of the frequency is constant positive in a first interval $[(40)]$, is zero in a second interval, or $[(41)]$ ~~and~~ is constant negative in a third interval, ~~(42)~~, and wherein ~~they are added to create a~~ resulting pulse response (h_ϕ) of the phase is created so that the resulting pulse response (h_ϕ) of the phase is constant in at least a middle interval $[(43)]$ and is otherwise zero.

11. (currently amended) The apparatus of claim 10, wherein the phase determination device $[(3)]$ has a counter $[(24)]$ whose count is read out at a constant sampling rate (f_{a2}) .

12. (currently amended) The apparatus of claim 10, wherein the first filter $[(4)]$ has an integrator $[(10)]$, a differentiator $[(11)]$ and a first sampling-rate converter $[(14)]$ arranged between the integrator $[(10)]$ and the differentiator $[(11)]$ to reduce the sampling rate of the added-up phase values $(S_{a1}(i))$ by the factor N/B in comparison with the sampling rate frequency (f_{a2}) of the phase values $(C_{a1}(i))$.

13. (currently amended) The apparatus of claim 10, wherein the fraction $1/B$ is $1/3$, and the second filter $[(8)]$ has a first

delay element and a second delay element ~~two delay elements (15, 16)~~ and a subtractor, [(18)] which subtracts the added-up phase values ($S_{a1}(i-2)$) at the output of the second delay element [(16)] from the added-up phase values ($S_{a1}(i)$) at the input of the first delay element [(15)] to determine the estimated frequency (f_{a1}).

14. (currently amended) The apparatus of claim 10, wherein the fraction $1/B$ is $1/3$, and the second filter [(8)] has a first delay element and a second delay element ~~two delay elements (15, 16)~~ and adders ~~(20, 21)~~ which sum the added-up phase values ($S_{a1}(i)$) at the input of the first delay element [(15)], the added-up phase values ($S_{a1}(i-1)$) at the output of the first delay element, [(15)] and the added-up phase values ($S_{a1}(i-2)$) at the output of the second delay element [(16)] to determine the estimated phase (ϕ_{a1}).

15. (currently amended) The apparatus of claim 13, wherein a second sampling-rate converter ~~(37, 23)~~ is arranged to follow at least one of the adders ~~(20, 21)~~ and the subtractor [(18)] to reduce the sampling rate by a factor of 3.

16. (currently amended) The apparatus of claim 10, wherein the fraction $1/B$ is $1/6$, and the second filter [(8)] has a first, second, third, fourth, and fifth ~~five~~ delay elements ~~(26-30)~~, an

adder $[(31)]$ that adds up the added-up phase values $(S_{a1}(i))$ at the input of the first delay element $[(26)]$ and the added-up phase values $(S_{a1}(i-1))$ at the output of the first delay element $[(26)]$, and subtractors ~~$(32, 33)$~~ which subtract therefrom the added-up phase values $(S_{a1}(i-4))$ at the output of the fourth delay element $[(29)]$ and the added-up phase values $(S_{a1}(i-5))$ at the output of the fifth delay element $[(30)]$ to determine the estimated frequency (f_{a1}) .

17. (currently amended) The apparatus of claim 10, wherein the fraction $1/B$ is $1/6$, and the second filter $[(8)]$ has a first, second, third, fourth, and fifth ~~five~~ delay elements ~~$(26-30)$~~ and adders ~~$(34-36)$~~ which add up the added-up phase values $(S_{a1}(i-1))$ at the output of the first delay element $[(26)]$, the added-up phase values $(S_{a1}(i-2))$ at the output of the second delay element $[(27)]$, the added-up phase values $(S_{a1}(i-3))$ at the output of the third delay element $[(28)]$ and the added-up phase values $(S_{a1}(i-4))$ at the output of the fourth delay element $[(29)]$ to determine the estimated phase (ϕ_{a1}) .

18. (currently amended) The apparatus of claim 16, wherein a second sampling-rate converter ~~$(37, 23)$~~ is respectively arranged after at least one of the adders ~~$(34, 36)$~~ and the subtractors ~~$(32, 33)$~~ for reducing the sampling rate by a factor of 6.